2. CALMET MODELING

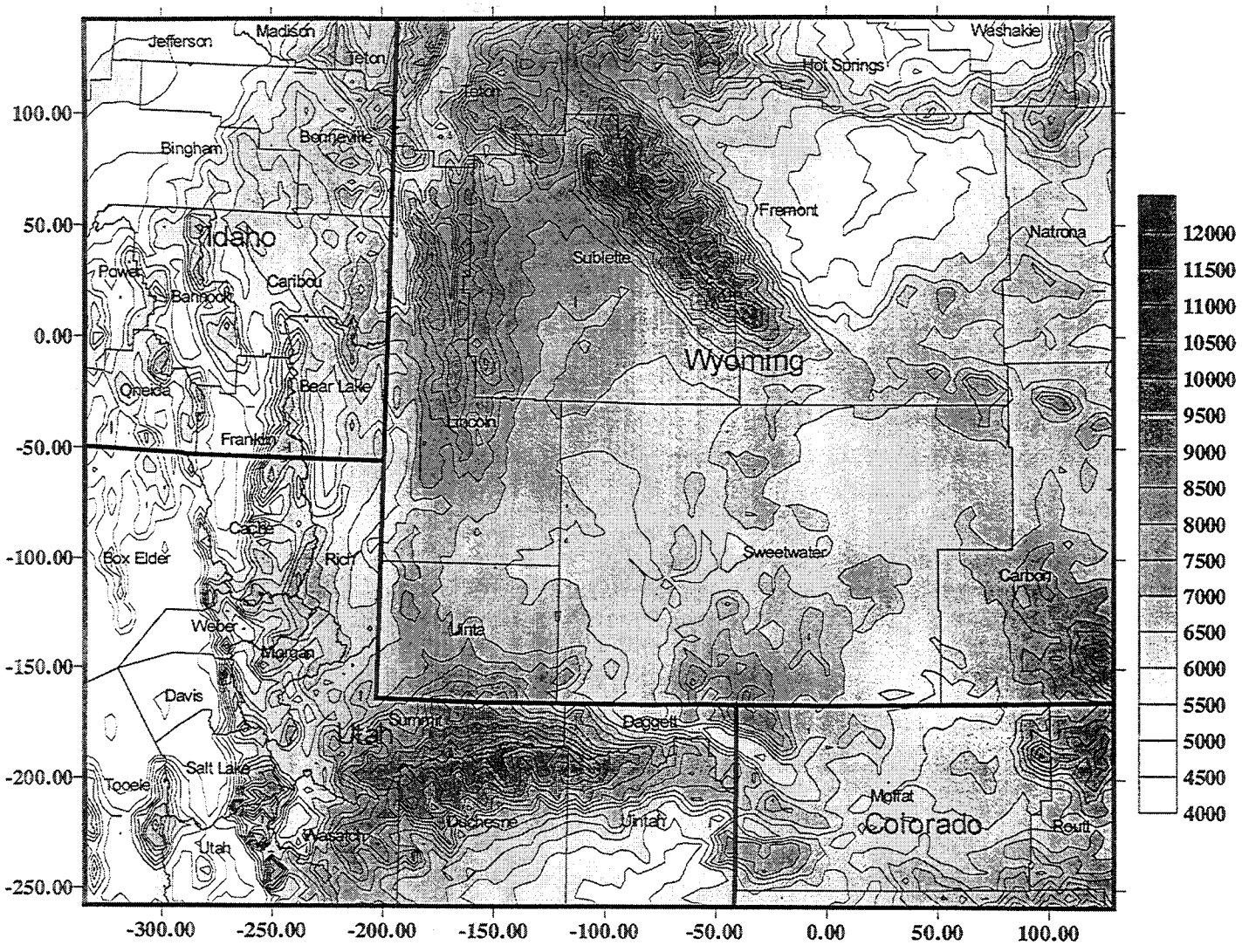
Version 5 of the CALMET (Level 990130) meteorological model (Scire et al., 1998) was applied to a modeling domain including southwest Wyoming, southeastern Idaho, northeastern Utah, and northwestern Colorado as depicted in Figure 2-1. CALMET includes a diagnostic wind model (Douglas and Kessler, 1990) which combines surface and upper-air meteorological data with diagnostic effects of terrain and other factors to generate three-dimensional wind fields. CALMET also includes other interpolation algorithms to generate three-dimensional temperature, pressure, stability, and other meteorological variables and two-dimensional precipitation fields. CALMET will be exercised on a 116 by 110 grid at a 4-km resolution. Due to the presence of complex terrain, wind fields in Southwestern Wyoming will be highly variable and complex. Wind observations are sparse and representative of very localized flow conditions. Thus there is little chance that a diagnostic wind model, such as CALMET, can accurately depict the complex flow fields using observations alone. Thus, output from a coarse grid (20-km) resolution simulation of the MM5 prognostic meteorological model was used as input into CALMET to define the synoptic-scale flow features; the CALMET diagnostic wind algorithms and local observations were then used to better characterize the local wind variations at the 4-km resolution. The MM5 simulation was performed using four dimensional data assimilation (FDDA) of analysis fields generated by interpolation of the standard National Weather Service (NWS) upper-air meteorological data. Thus, the three-dimensional MM5 meteorological fields implicitly contain the effects of the NWS upper-air meteorological observations, thus upper-air meteorological observations need not be provided as input into CALMET.

Model Domain

The Pinedale Anticline Project EIS CALMET modeling domain was defined to be the same as the Southwest Wyoming Technical Air Forum (SWWYTAF) domain as shown in Figure 2-1. The CALMET modeling domain is based on a Lambert Conformal Projection (LCP) and uses a 4-km resolution. The LCP projection is defined with a central longitude/latitude at (-108.55°, 42.55°) and first and second standard latitude parallels at 30° and 60°.

Terrain and Land Use Data

Terrain and land use data from the USGS were processed to obtain terrain elevation and predominate land use type for each of the 116 by 110 4-km by 4-km grid cells in the CALMET domain. The average terrain elevation in each 4-km by 4-km grid cell was obtained by averaging the terrain elevations in the grid cell from the USGS database which are provided at an approximately 900-m by 900-m resolution. Figure 2-1 displays the terrain heights in the modeling domain generated from the CALMET terrain inputs.



Pinedale Terrain Heights (ft)

Figure 2-1. Terrain heights used in the Pinedale Anticline Project EIS CALMET modeling.

The USGS raw landuse data come as 100-m by 100-m pixels. These data were matched to the CALMET LCP 4-km by 4-km grid and the most predominate landuse type selected to represent landuse across the grid cell. Table 2-1 summarize the CALMET default landuse categories. Figure 2-2 display the spatial distribution or the landuse data based on the CALMET inputs.

Table 2-1. Default CALMET land use categories and associated geophysical parameters based on the U.S. Geological Survey Land Use Classification System (14-category system). (Source: Scire et al, 1998).

Land Use Type	Description	Surface Roughness (m)	Albedo	Bowen Ratio	Soil Heat Flux Parameter	Anthropogenic Heat Flux (W/m^2)	Leaf Area Index
10	Urban or built-up land	1.0	0.18	1.5	.25	0.0	0.2
20	Agricultural land - unirrigated	0.25	0.15	1.0	.15	0.0	3.0
-20*	Agricultural land - irrigated	0.25	0.15	0.5	.15	0.0	3.0
30	Rangeland	0.05	0.25	1.0	.15	0.0	0.5
40	Forest land	1.0	0.10	1.0	.15	0.0	7.0
50	Water	0.001	0.10	0.0	1.0	0.0	0.0
51	Small water body	0.001	0.10	0.0	1.0	0.0	0.0
55	Large water body	0.001	0.10	0.0	1.0	0.0	0.0
60	Wetland	1.0	0.10	0.5	.25	0.0	2.0
61	Forested wetland	1.0	0.1	0.5	0.25	0.0	2.0
62	Nonforested wetland	0.2	0.1	0.1	0.25	0.0	1.0
70	Barren land	0.05	0.30	1.0	.15	0.0	0.05
80	Tundra	.20	0.30	0.5	.15	0.0	0.0
90	Perennial snow or ice	.20	.70	0.5	.15	0.0	0.0

*Negative values indicate "irrigated" land use

Surface Meteorological Database

CALMET requires hourly surface observations of wind speed, wind direction, temperature, cloud cover, ceiling height, surface pressure, relative humidity, and precipitation type (i.e., rain or snow). As part of the Southwest Wyoming Technical Air Forum (SWWYTAF), Air Resources Specialists (ARS) archived several surface meteorological datasets. These data include industrial sites in the Green River Basin, Remote Automatic Weather Sites (RAWS), observations collected as part of the Mount Zirkel Visibility Study (Zirkel Sites), data from two National Dry Deposition Network (NDDN) sites (Pinedale and Centennial), and State of Wyoming Department of Transportation (WYDOT) sites. However, routine standard NWS data were not included with the ARS 1995 archived SWWYTAF meteorological database. The NWS sites are critical for CALMET modeling as they are typically the only sites that measure a complete set of the meteorological variables required by CALMET (notably the inclusion of cloud cover and ceiling height).

As part of the Mount Zirkel Visibility Study (MZVS), surface meteorological data for many NWS and FAA sites in the region were also archived. However, the MZVS modeling period was a split 1994/1996 year so did not include the end of 1995. Furthermore, many of these sites are NWS Class II sites that just operate for portions of the year or for just portions of the day (e.g., daylight hours). Several core 24-hour NWS Class I sites were identified and NWS

data were purchased from the Western Regional Climate Center (WRCC) for use in the Pinedale Anticline Project EIS study. Thus, a complete set of 1995 surface meteorological data would be available at these core NWS sites for all of 1995. Below the surface meteorological sites used in the Project EIS CALMET modeling are summarized:

Green River Basin Industrial Sites: Amoco, Exxon, General Chemical, Naughton, OCI, and TG Soda;

Remote Automatic Weather Sites (RAWS): Anderson Ridge, Burro Hill, Camp Creek, Cow Creek, Elkhorn, Getch Hollow, Grace, Grand Teton, Pole Canyon, Raspberry, Riley Ridge, Snider Basin, and Wind River;

Wyoming Department of Transportation Sites (WYDOT): Beaver Rim, Bitter Creek, Continental Divide, First Divide, Hiland, and Pathfinder Hill;

Zirkel Sites: Baggs, Craig Mountain, and Juniper Mountain;

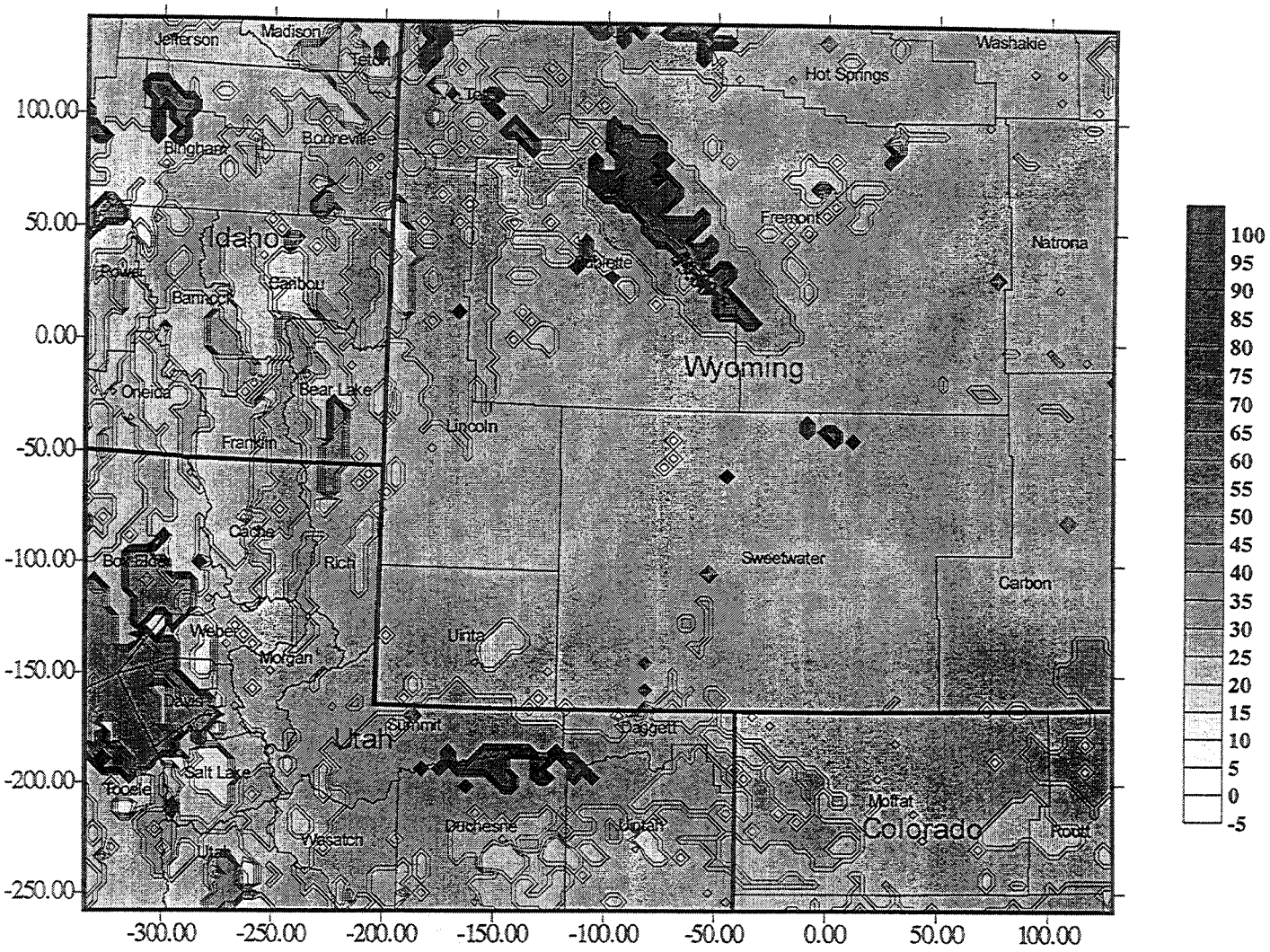
National Dry Deposition Network Sites (NDDN): Pinedale and Centennial;

Core NWS Class I Sites: Denver (03017), Denver (23062), Grand Junction (23066), Cheyenne (24018), Lander (24021), Rock Springs (24027), Casper (24089), Salt Lake City (24127), and Poccatello (24156); and

NWS Class II Sites from MZVS Database: Evanston, Hayden/Yampa Valley, Ogden/Hill AFB, Jackson Hole, Riverton, Rawlins, Soda Springs, Vernal, and Worland.

Figure 2-3 displays the locations of the surface meteorological sites used in the Project EIS CALMET modeling. The surface meteorological variables required by CALMET were extracted from the SWWYTAF/ARS, WRCC/NWS, and MZVS/NWS databases and formatted into the format required by CALMET. Extensive quality assurance and quality control (QA/QC) was performed as part of the processing. This QA/QC identified many erroneous and potentially erroneous meteorological parameters in the database. Where possible, such errors were corrected. If not possible to fix an erroneous value or if a meteorological parameter at a given site was questionable, it was set to missing.

Missing data at a site were filled in by linear interpolation across the hours using the closest valid hourly data on either side of the missing data hour(s). However, it is important that such interpolation not be performed over prolonged periods during which significant meteorological variations would occur (e.g., a diurnal cycle). Thus, missing data were only filled in when the missing data period was less than 12 hours long.



Pinedale Landuse

Figure 2-2. Spatial distribution of the land-use categories used in the Pinedale Anticline Project EIS CALMET modeling.

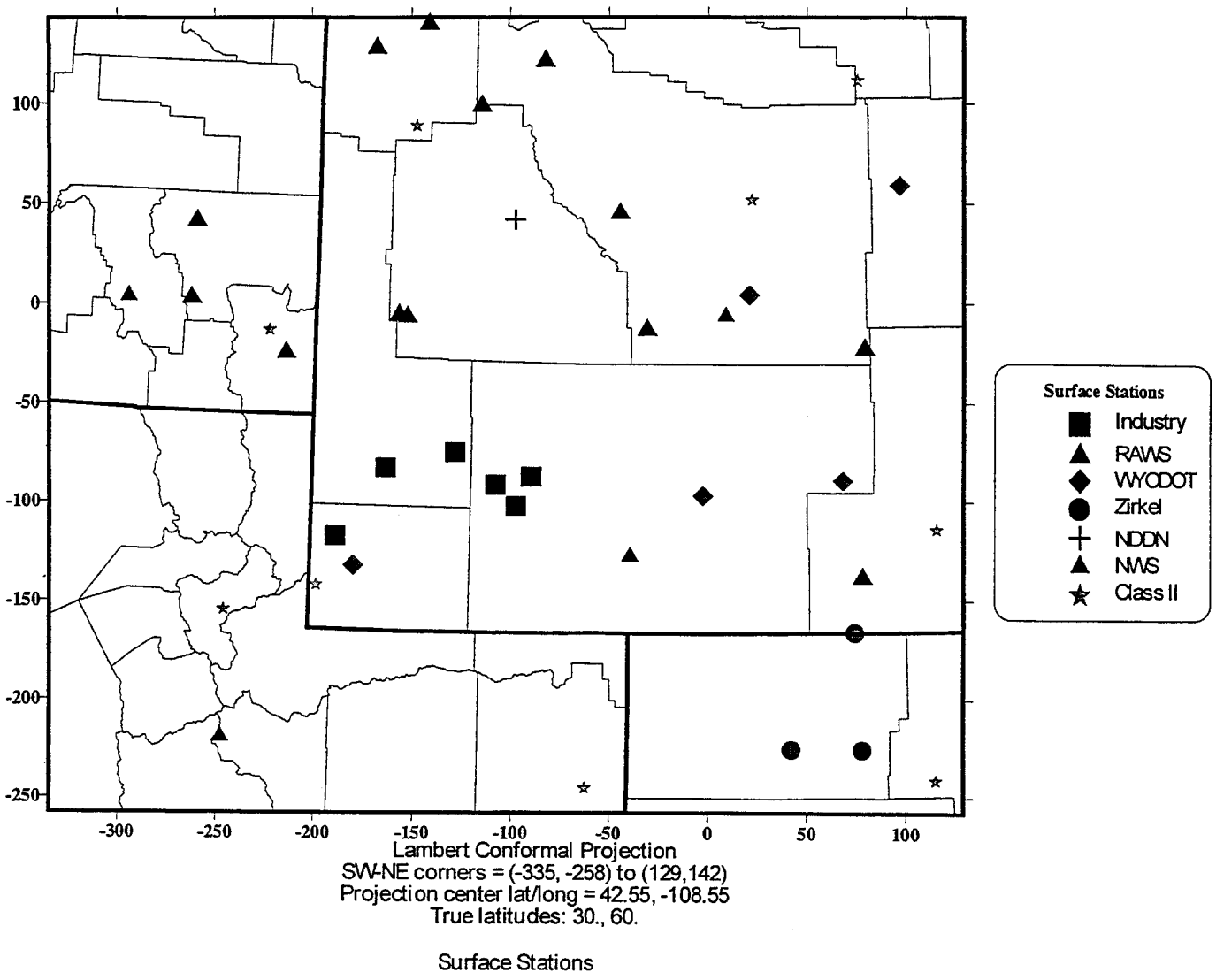


Figure 2-3. Locations of surface meteorological sites used in the Pinedale Anticline Project EIS CALMET modeling, the Project area is located immediately to the southeast of the Pinedale NDDN site..

Quality Assurance/Quality Control

As part of the SWWYTAF, Air Resource Specialists (ARS) compiled a "comprehensive electronic database of meteorology and air quality data collected during 1995 in southwestern Wyoming" (ARS, 1998). As stated in the ARS report "the database will be used for CALPUFF/CALMET modeling analysis". These data were obtained from BLM on a CD. ARS actually did very little QA/QC of the database themselves instead relying on conversations with appropriate on-site personnel on their QA/QC procedures and generating wind roses and examining them for reasonableness.

In order to generate reliable meteorological fields for CALPUFF modeling, accurate and reliable wind and other meteorological inputs are needed for CALMET. Thus, ENVIRON performed a much more comprehensive QA/QC of the ARS SWWYTAF, the NWS Class I, and the MZVS NWS Class II databases. This QA/QC included, but was not limited, to the following activities:

- Range checks of the meteorological variables by month;
- Checks on the changes in consecutive hourly meteorological variables for reasonableness;
- Comparison of the average, maximum, minimum, and standard deviation of variables within a site and across nearby sites;
- Comparison of concurrent meteorological variables across nearby sites;
- Checks for identical consecutive values indicating a stuck instrument or recording; and
- Visual inspection of the data.

The following summarizes the results of our QA/QC analysis of the surface meteorological databases and the resultant justifications for setting data values to missing.

Industrial Sites in the Green River Basin: There were six surface meteorological sites located at industrial facilities in the Green River Basin (see Figure 2-3). Each site had a different format, different valid meteorological parameters, and different missing data conventions. The data from the industrial sites passed most of the QA/QC checks. The data file from the Naughton site contained many spurious characters in the data fields, which required hand editing and reformatting to correct. In addition, the QA/QC uncovered some erroneous hourly temperature data in the Naughton database on April 20-21, 1995 that were set to missing values. The ARS documentation for the dates for the OCI data was in error. Finally, the TG Soda Ash data file did not end properly so special considerations had to be added to the software to account for this fact.

RAWS Sites: There were 13 RAWS surface meteorological sites used. These data were particularly troublesome and suspect. Missing data were identified by stars (*) in the data field and there were a lot of scattered spurious invalid characters in the data files. Data fields with invalid characters (including stars) were treated as missing in the processing of the RAWS data. The RAWS pressure readings were much too high for the high terrain of the modeling domain so were set to missing (suspect they were pressure adjusted to sea level, whereas CALMET needs station pressure). It appears that some or all of the RAWS sites sometimes used zero wind speed and wind direction (WS/WD) as a missing data value, whereas the convention is to use zero WS/WD for calms. Analysis of the time series revealed that many of the RAWS zero WS/WD could not be calms due to the presence of high winds

during the remainder of the day and during the same hours at nearby sites. Thus, zero WS/WD in the RAWS database were set to missing. The Grace RAWS site contained numerous hours of bad data (approximately 20 percent) which were set to missing. Many of the RAWS sites contained relatively humidities, which exceeded 100 percent. If relative humidity values were less than 106 percent but greater than 100 percent, they were set to 100 percent. The WS/WD data at the Wind River site were missing for large portions of the year and highly suspect the remainder of the time so were set to missing for the entire year. The Burro Hill relative humidity looked erroneous so were set to missing. During large portions of April 1995, relative humidity at the Snider Basin site looked erroneous so were set to missing. Finally, during large portions of July, the temperature data at Getch Hollow were clearly erroneous so were set to missing for all of July.

WYDOT Sites: The documentation of the format for the data variables in the WYDOT database in the ARS SWWYTAF report was incorrect. The correct format had to be deduced from the raw data file. Although the format for the variables was incorrect in the ARS documentation, the types of meteorological variables present were the same. Because this was the only data source in the ARS SWWYTAF database which the documentation reported the data were reported as UTC (GMT) time rather than local time ARS was contacted to confirm the time convention and variables units. ARS responded that everything they know about the database was in the report, so UTC times were assumed for the WYDOT data. Other than that, the WYDOT data passed all of the QA/QC checks.

Zirkel Sites: Surface data from three sites from the Mount Zirkel Visibility Study were included in the archive: Baggs, Juniper Mountain, and Craig Mountain. The data from all three sites appeared to be of good quality with only anomaly being some relative humidity values above 100 percent (but not above 105 percent) which were pegged at 100 percent.

NDDN Sites: Data were available from two CASTNet or National Dry Deposition Network (NDDN) sites at Pinedale and Centennial. Given the proximity to the proposed Project, the Pinedale site is of particular importance for the CALMET/CALPUFF modeling. Unfortunately, these data were missing for October-December 1995. When available, the data appear to be reasonable.

NWS Class I Sites: With one exception, data from the 9 Class I NWS sites were fairly complete for 1995 and of very high quality. The exception was the two Denver sites. One site never reported winds, whereas at the other the wind data were missing after the first few months of the year. However, given the distance between Denver and southwest Wyoming, these missing data will in no way affect the calculations.

NWS Class II Sites: The NWS Class II sites (or MZVS sites) are data collected at local small airports by observers. Some of the parameters are automated (e.g., temperature) whereas others are made by observers (e.g., winds). These data are usually limited to daylight hours of airport operation and are sporadic during the day. Processing of these data found an unusually high occurrence of calms (zero wind speed and wind direction) at all sites. An examination of the database revealed that zero wind speed and wind direction were sometimes used to indicate missing data. Furthermore, visual inspection of the raw data revealed suspect wind observations. Given the poor data recovery and questionable nature of the wind observations at the NWS Class II sites, they were set to missing in the CALMET analysis.

Summary of Data Availability

Table 2-2 summarizes the amount of valid data values in the processed database (includes original valid data as well as data filled in the interpolation) and the ranges of each of the meteorological variables. For each site and meteorological variable, the percent of valid data values through the year is displayed along with the average, standard deviation, maximum, minimum, and percent of zero values.

Wind Speed/Wind Direction: Except for the NWS Class II (MZVS) sites, whose wind speed and wind direction were set to missing, and the Denver sites, valid data of over 50 percent were reported at all sites with most sites containing 80 percent valid data for the 1995 year. Seven sites contained valid data for every hour of the year. There was some concern regarding the high percentage of calms at the TG Soda (31%), Snider Basin (28%), and to a lessor extent some other sites. We examined the time series of wind speeds at these sites and found the calms appeared to be real to the best of our knowledge. The number of calms were also compared against the wind rose plots in the ARS SWWYTAF report and agreed favorably. Thus, we did not see any reason to justify setting them to missing.

Temperature: Most sites contained fairly high (80 percent or better) valid temperature data. The annual average temperatures across all sites were within 10 °K of each other and the variability in the hourly temperatures (represented by the standard deviation) were very similar across sites (within 2 °K).

Pressure: Pressure was only available at the NWS Class I and II sites. Data capture at the NWS Class I sites was mostly complete. Pressure variations across the different sites are consistent with the different elevations of the sites and the variability in hourly pressure across sites very similar.

Relative Humidity: For the most part, relative humidity values appeared to be fairly consistent across the different sites. Relative humidity at the OCI industrial site appeared high, however the data did not appear anomalous.

Opaque Sky Cover: The total opaque sky cover was just available from the NWS Class I sites. The average value, variability, and range were very consistent across the different sites.

Ceiling Height: The ceiling height variable exhibited some variability across sites. Note that unlimited ceiling (999) were not included to obtain the average values in Table 2-2. Given that these observations are based on visual observations so are subjective in nature relying on local topography to estimate the ceiling height, some variability across sites is expected.

Precipitation Code: The precipitation code describes whether precipitation is liquid or frozen (snow). This variable is used in the CALPUFF wet scavenging algorithm. If this parameter is missing, then the phase of the precipitation is based on the ambient temperature. This parameter is rarely reported so was set to missing across all sites so that the better characterized and resolved temperature fields could be use to determine the phase of precipitation.

Precipitation Database

24-hour precipitation data from almost 50 Cooperative Weather Sites (COOP) were contained in the ARS SWWYTAF CD database. This network consists of local volunteers using low-resolution instrumentation manually recording and reporting the data. ARS concludes, "These data are deemed to be of reasonable quality."

We reviewed the COOP database and found that data at all sites for the month of December 1995 were missing. Thus, we were required to purchase a set of 24-hour precipitation data for the COOP network and the State of Wyoming for the entire 1995 year from the WRCC.

CALMET requires hourly precipitation data at each site. The processing of 24-hour precipitation events into hourly observations needs to account for the following: the duration of a typical storm event; and the fact that CALPUFF will treat an hourly precipitation observation of less than .01 inches/hour as zero. To treat the former, the 24-hour observations that occurred during January-April and October-December were assumed to be primarily due to storm passages so were initially assumed to occur during the full 24-hour period. 24-hour precipitation observations that occurred during May-September were assumed to be primarily due to convective activity so were initially assumed to occur during the afternoon hours from 1200-1900 LST. To account for CALPUFF's treatment of hourly observations less than 0.01 in/hr as zero, the length of the precipitation event during the 24-hour period was reduced so that the hourly precipitation values during the sequence of hours were always greater than 0.01 in/hr and the 24-hour total added up to the 24-hour observations.

After generating the CALMET-ready hourly precipitation files the data were displayed as 24-hour totals across days and the data compared across sites to assess the occurrence of precipitation on the same days and identifying anomalous sites. The 24-hour totals were also compared against the original raw data to assure it was processed correctly.

Figure 2-4 displays the locations of the precipitation sites used in the CALMET modeling. Note that since CALPUFF will only be exercised within the southwest Wyoming portion of the modeling domain, only sites in that portion of the domain are needed.

CALMET Control File

CALMET contains many options for defining the parameters for the interpolation of the meteorological data. These options are controlled by the CALMET.INP run control file. An example CALMET.INP file for a January CALMET simulation is provided in Exhibit 2-1. In most cases, default parameters were specified for the different CALMET options. In some cases, parameters consistent with the CALMET modeling performed as part of the Mount Zirkel Visibility Study were specified. This file has some internal documentation describing each parameter. The user is referred to the CALMET user's guide (Scire et al., 1998) for a more detailed description of each parameter.

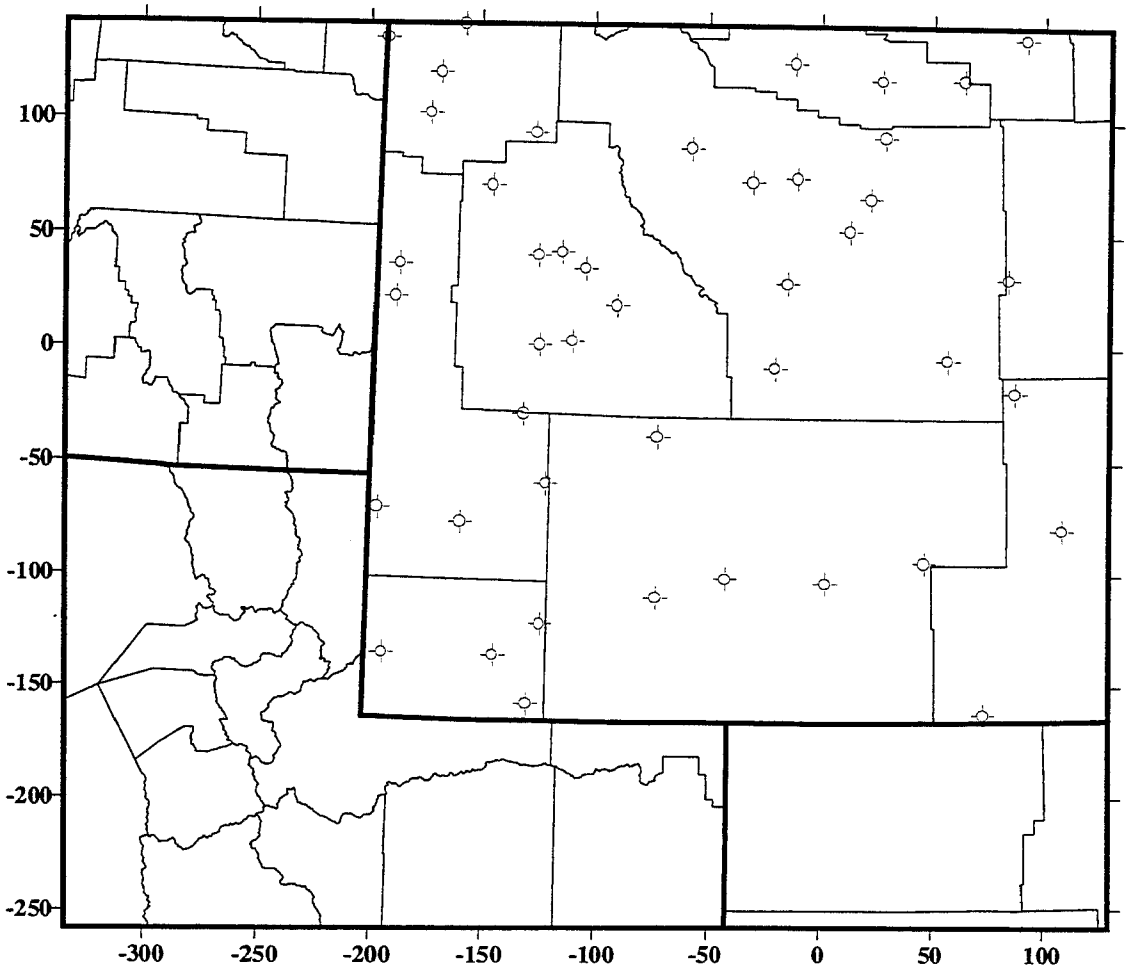


Figure 2-4. Location of the COOP precipitation measurement sites used in the Pinedale Anticline Project EIS CALMET modeling.

Table 2-2. Percent of valid data values at each site and for each meteorological parameter for January through December 1995.

Wind Speed (m/s)
site for Type= WS

	Percent	Avg	Sig	Max	Min	%zero
Amoco	97.56	5.68	2.73	18.96	0.00	0.36
Exxon	86.27	4.26	3.03	18.75	0.00	1.96
GenChem	90.48	3.80	3.31	19.67	0.00	13.29
Naughton	100.00	4.59	2.67	16.54	0.00	2.11
OCI	99.73	3.67	2.73	18.23	0.00	0.31
TG Soda	97.72	2.32	2.76	17.70	0.00	30.71
RAWS Anderson Ridge	86.46	4.99	3.01	17.43	0.00	2.15
RAWS Burro Hill	86.32	2.76	1.66	14.53	0.00	4.84
RAWS Camp Creek	86.43	6.24	4.00	23.69	0.00	2.23
RAWS Cow Creek	85.38	5.30	2.64	21.46	0.00	0.90
RAWS Elkhorn	86.46	2.96	2.49	14.31	0.00	16.64
RAWS Getch Hollow	85.33	3.09	1.70	17.97	0.00	1.77
RAWS Grace	80.58	2.02	1.16	4.02	0.00	10.60
RAWS Grand Teton	86.29	2.60	2.29	13.41	0.00	18.90
RAWS Pole Canyon	85.23	4.05	2.20	15.65	0.00	3.38
RAWS Raspberry	45.19	2.56	1.90	9.39	0.00	12.15
RAWS Riley Ridge	86.46	7.09	4.12	25.93	0.00	2.02
RAWS Snider Basin	86.46	2.22	2.32	15.96	0.00	27.66
RAWS Wind River	50.62	3.24	2.62	16.54	0.00	10.37
WYODOT Beaver Rim	67.28	6.01	3.68	21.99	0.17	0.00
WYODOT Bitter Creek	70.30	5.83	3.13	19.89	0.00	0.03
WYODOT Cont. Divide	71.71	5.81	2.98	20.23	0.16	0.00
WYODOT First Divide	72.99	4.89	2.81	16.43	0.00	0.06
WYODOT Hiland	60.73	6.11	3.88	36.55	0.00	0.06
WYODOT Pathfinder Hi	72.71	4.65	2.61	19.33	0.00	0.03
Zirkel Baggs	91.51	4.73	2.67	19.52	0.36	0.00
Zirkel Craig Mtn.	73.24	1.81	1.80	13.90	0.00	7.79
Zirkel Juniper Mtn.	87.26	6.69	3.70	24.31	0.00	0.95
NDDN Pinedale WY	72.27	4.09	2.62	17.80	0.00	1.01
NDDN Centennial WY	76.63	4.63	2.65	16.20	0.00	1.50
NWS Denver CO (03017	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NWS Denver CO (23062	16.16	3.55	2.08	14.92	0.00	5.16
NWS Grand Junction C	100.00	3.73	1.77	20.58	0.00	2.27
NWS Cheyenne WY (240	83.29	5.64	2.93	21.61	0.00	2.60
NWS Lander WY (24021	100.00	2.81	1.99	16.46	0.00	13.82
NWS Rock Springs (24	100.00	4.74	3.23	20.06	0.00	10.83
NWS Casper WY (24089	100.00	4.92	3.10	20.58	0.00	5.74
NWS Salt Lake City U	100.00	3.80	2.06	15.43	0.00	4.46
NWS Poccatello ID (2	100.00	4.52	2.75	19.55	0.00	5.09
MZVS Evanston WY (EV	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Hayden/Yampa Va	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Ogden/Hill AFB	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Jackson Hole WY	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Riverton WY (RI	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Rawlins WY (RWL	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Soda Springs ID	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Vernal UT (VELN	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Worland WY (WRL	0.00	-99.00	-99.00	-999.00	999.00	-9.00

Wind Direction (0-360)
site for Type= WD

	Percent	Avg	Sig	Max	Min	%zero
Amoco	97.56	228.20	73.33	359.00	0.00	0.40
Exxon	86.27	224.20	93.75	359.00	0.00	2.14
GenChem	90.48	164.35	114.64	359.00	0.00	13.41
Naughton	100.00	207.10	96.15	357.00	0.00	4.46
OCI	99.73	209.82	84.74	359.00	0.00	0.38
TG Soda	97.72	155.89	123.74	359.00	0.00	30.77
RAWS Anderson Ridge	86.46	221.55	98.98	359.00	0.00	2.38
RAWS Burro Hill	86.32	174.20	107.30	358.00	0.00	4.85
RAWS Camp Creek	86.43	228.86	80.11	359.00	0.00	2.29
RAWS Cow Creek	85.38	185.56	79.62	359.00	0.00	1.08
RAWS Elkhorn	86.46	189.35	115.92	359.00	0.00	16.72
RAWS Getch Hollow	85.33	164.91	101.21	359.00	0.00	1.98
RAWS Grace	80.58	177.64	110.16	359.00	0.00	10.65
RAWS Grand Teton	86.29	147.62	118.73	359.00	0.00	19.28
RAWS Pole Canyon	85.23	174.01	104.24	359.00	0.00	3.87
RAWS Raspberry	45.19	188.64	94.76	359.00	0.00	12.02
RAWS Riley Ridge	86.46	244.83	71.45	359.00	0.00	1.74
RAWS Snider Basin	86.46	152.80	111.26	359.00	0.00	27.44
RAWS Wind River	50.62	182.89	109.75	359.00	0.00	10.58
WYODOT Beaver Rim	67.28	229.22	83.28	359.00	0.00	0.17
WYODOT Bitter Creek	70.30	232.70	84.75	359.00	0.00	0.06
WYODOT Cont. Divide	71.71	210.57	82.06	359.00	0.00	0.06
WYODOT First Divide	72.99	231.49	71.06	359.00	0.00	0.09
WYODOT Hiland	60.73	225.15	81.25	358.00	0.00	0.09
WYODOT Pathfinder Hi	72.71	207.56	96.30	359.00	0.00	0.16
Zirkel Baggs	91.51	176.05	84.79	359.00	0.00	0.30
Zirkel Craig Mtn.	73.24	185.77	99.07	359.00	0.00	7.87
Zirkel Juniper Mtn.	87.26	221.73	81.73	359.00	0.00	1.09
NDDN Pinedale WY	72.27	179.78	106.73	359.00	0.00	1.20
NDDN Centennial WY	76.63	250.75	67.06	359.00	0.00	1.56
NWS Denver CO (03017	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NWS Denver CO (23062	16.16	158.35	99.81	350.00	0.00	8.12
NWS Grand Junction C	100.00	163.81	96.72	350.00	0.00	4.25
NWS Cheyenne WY (240	83.29	213.43	102.87	350.00	0.00	6.26
NWS Lander WY (24021	100.00	170.37	112.80	350.00	0.00	16.16
NWS Rock Springs (24	100.00	181.50	97.88	350.00	0.00	11.27
NWS Casper WY (24089	100.00	182.45	103.56	350.00	0.00	8.18
NWS Salt Lake City U	100.00	177.63	96.88	350.00	0.00	7.66
NWS Poccatello ID (2	100.00	181.02	96.82	350.00	0.00	7.23
MZVS Evanston WY (EV	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Hayden/Yampa Va	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Ogden/Hill AFB	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Jackson Hole WY	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Riverton WY (RI	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Rawlins WY (RWL	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Soda Springs ID	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Vernal UT (VELN	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Worland WY (WRL	0.00	-99.00	-99.00	-999.00	999.00	-9.00

Temperature (degrees K)
site for Type=TEMP

	Percent	Avg	Sig	Max	Min	%zero
Amoco	97.56	276.90	9.35	299.54	254.09	0.00
Exxon	89.14	279.36	10.13	305.65	247.45	0.00
GenChem	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Naughton	99.13	277.24	11.05	303.65	233.15	0.00
OCI	99.73	278.83	10.85	307.12	244.96	0.00
TG Soda	97.72	279.24	10.34	307.15	249.15	0.00
RAWS Anderson Ridge	86.46	278.18	10.80	312.04	245.37	0.00
RAWS Burro Hill	86.32	277.63	9.27	301.98	245.48	0.00
RAWS Camp Creek	86.43	279.76	10.55	309.26	249.82	0.00
RAWS Cow Creek	85.38	280.82	11.09	314.26	250.37	0.00
RAWS Elkhorn	86.46	277.62	11.07	310.93	245.93	0.00
RAWS Getch Hollow	75.21	275.43	10.04	315.32	240.04	0.00
RAWS Grace	80.58	281.86	11.24	317.04	252.04	0.00
RAWS Grand Teton	86.29	279.41	10.84	315.93	255.37	0.00
RAWS Pole Canyon	85.23	280.57	10.45	313.71	255.37	0.00
RAWS Raspberry	45.21	276.04	9.43	297.65	249.04	0.00
RAWS Riley Ridge	86.46	274.93	9.33	304.26	251.48	0.00
RAWS Snider Basin	86.46	276.19	8.87	300.43	246.71	0.00
RAWS Wind River	86.35	276.41	9.83	304.26	244.82	0.00
WYODOT Beaver Rim	67.51	277.39	9.57	305.37	251.34	0.00
WYODOT Bitter Creek	70.67	276.91	9.18	305.65	254.12	0.00
WYODOT Cont. Divide	72.08	277.23	9.15	306.21	253.57	0.00
WYODOT First Divide	73.49	276.37	8.89	302.15	250.79	0.00
WYODOT Hiland	60.90	275.22	8.69	306.76	250.93	0.00
WYODOT Pathfinder Hi	73.12	277.72	9.96	307.98	249.82	0.00
Zirkel Baggs	88.36	281.77	10.33	310.04	251.92	0.00
Zirkel Craig Mtn.	73.49	283.21	8.68	306.40	261.19	0.00
Zirkel Juniper Mtn.	90.92	279.84	9.21	303.61	258.01	0.00
NDDN Pinedale WY	69.84	277.89	9.65	300.35	252.95	0.00
NDDN Centennial WY	98.46	272.39	8.57	293.95	251.65	0.00
NWS Denver CO (03017	83.55	284.49	10.14	309.82	255.93	0.00
NWS Denver CO (23062	16.16	275.01	8.28	294.26	255.37	0.00
NWS Grand Junction C	100.00	285.42	10.17	313.15	262.04	0.00
NWS Cheyenne WY (240	100.00	281.05	10.28	308.15	255.37	0.00
NWS Lander WY (24021	100.00	280.73	11.12	309.26	255.37	0.00
NWS Rock Springs (24	99.78	279.04	10.12	305.93	255.37	0.00
NWS Casper WY (24089	100.00	280.98	10.96	310.93	255.37	0.00
NWS Salt Lake City U	100.00	285.14	9.77	314.26	262.04	0.00
NWS Poccatello ID (2	100.00	282.21	9.76	309.26	255.37	0.00
MZVS Evanston WY (EV	33.30	282.50	9.48	304.85	255.35	0.00
MZVS Hayden/Yampa Va	79.68	279.26	9.00	306.45	255.35	0.00
MZVS Ogden/Hill AFB	87.29	285.27	9.08	310.35	260.95	0.00
MZVS Jackson Hole WY	86.85	277.74	9.09	303.15	255.35	0.00
MZVS Riverton WY (RI	77.39	281.68	11.12	308.75	255.35	0.00
MZVS Rawlins WY (RWL	85.17	281.39	9.87	306.45	255.95	0.00
MZVS Soda Springs ID	59.33	280.81	9.55	305.95	255.95	0.00
MZVS Vernal UT (VELN	58.14	282.72	10.01	307.55	255.95	0.00
MZVS Worland WY (WRL	86.37	282.37	11.41	310.35	255.35	0.00

Pressure (mb)

site for Type=PRES

	Percent	Avg	Sig	Max	Min	%zero
Amoco	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Exxon	0.00	-99.00	-99.00	-999.00	999.00	-9.00
GenChem	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Naughton	0.00	-99.00	-99.00	-999.00	999.00	-9.00
OCI	0.00	-99.00	-99.00	-999.00	999.00	-9.00
TG Soda	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Anderson Ridge	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Burro Hill	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Camp Creek	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Cow Creek	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Elkhorn	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Getch Hollow	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Grace	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Grand Teton	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Pole Canyon	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Raspberry	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Riley Ridge	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Snider Basin	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Wind River	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Beaver Rim	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Bitter Creek	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Cont. Divide	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT First Divide	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Hiland	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Pathfinder Hi	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Zirkel Baggs	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Zirkel Craig Mtn.	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Zirkel Juniper Mtn.	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NDDN Pinedale WY	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NDDN Centennial WY	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NWS Denver CO (03017	83.55	833.79	4.96	846.12	814.97	0.00
NWS Denver CO (23062	16.16	835.58	6.44	849.00	811.92	0.00
NWS Grand Junction C	100.00	852.70	5.32	867.80	832.41	0.00
NWS Cheyenne WY (240	100.00	811.11	5.19	823.77	787.03	0.00
NWS Lander WY (24021	100.00	828.58	5.29	843.42	808.53	0.00
NWS Rock Springs (24	100.00	793.19	6.30	807.35	768.74	0.00
NWS Casper WY (24089	100.00	836.74	6.07	851.04	816.32	0.00
NWS Salt Lake City U	100.00	871.34	5.69	887.44	849.34	0.00
NWS Poccatello ID (2	100.00	862.75	5.99	879.48	845.62	0.00
MZVS Evanston WY (EV	23.31	798.93	5.28	819.50	776.70	0.00
MZVS Hayden/Yampa Va	79.74	798.94	6.31	813.00	776.60	0.00
MZVS Ogden/Hill AFB	86.61	853.78	7.29	869.10	831.80	0.00
MZVS Jackson Hole WY	87.08	802.98	5.86	817.60	782.40	0.00
MZVS Riverton WY (RI	77.39	831.25	5.24	846.50	811.10	0.00
MZVS Rawlins WY (RWL	85.17	794.03	5.87	819.60	769.50	0.00
MZVS Soda Springs ID	59.51	820.99	5.87	835.50	799.90	0.00
MZVS Vernal UT (VELN	55.94	837.76	5.02	865.20	816.30	0.00
MZVS Worland WY (WRL	86.37	871.85	5.65	888.40	849.80	0.00

Relative Humidity (%)

site for Type= RH

	Percent	Avg	Sig	Max	Min	%zero
Amoco	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Exxon	0.00	-99.00	-99.00	-999.00	999.00	-9.00
GenChem	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Naughton	0.00	-99.00	-99.00	-999.00	999.00	-9.00
OCI	99.73	71.34	19.23	100.00	29.00	0.00
TG Soda	97.72	60.59	22.26	100.00	12.00	0.00
RAWS Anderson Ridge	86.46	63.60	25.30	100.00	3.00	0.00
RAWS Burro Hill	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Camp Creek	86.43	57.30	25.95	100.00	4.00	0.00
RAWS Cow Creek	85.38	59.03	25.09	100.00	8.00	0.00
RAWS Elkhorn	86.46	58.03	22.86	100.00	3.00	0.00
RAWS Getch Hollow	85.33	54.07	21.33	100.00	3.00	0.00
RAWS Grace	80.58	52.66	22.41	100.00	8.00	0.00
RAWS Grand Teton	86.29	70.12	24.28	100.00	12.00	0.00
RAWS Pole Canyon	85.23	60.72	26.76	100.00	10.00	0.00
RAWS Raspberry	44.77	46.66	25.43	100.00	1.00	0.00
RAWS Riley Ridge	86.46	66.57	27.37	100.00	0.00	0.01
RAWS Snider Basin	77.96	50.64	23.74	100.00	1.00	0.00
RAWS Wind River	86.35	51.90	24.31	100.00	2.00	0.00
WYODOT Beaver Rim	67.51	61.77	21.59	99.00	18.00	0.00
WYODOT Bitter Creek	70.67	66.29	23.44	99.00	18.00	0.00
WYODOT Cont. Divide	72.08	53.89	21.73	89.00	10.00	0.00
WYODOT First Divide	73.49	65.58	23.08	100.00	17.00	0.00
WYODOT Hiland	60.90	61.54	18.71	94.00	14.00	0.00
WYODOT Pathfinder Hi	73.12	58.11	20.23	93.00	14.00	0.00
Zirkel Baggs	87.87	57.58	22.01	100.00	5.00	0.00
Zirkel Craig Mtn.	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Zirkel Juniper Mtn.	90.54	56.07	23.02	100.00	9.00	0.00
NDDN Pinedale WY	72.27	56.98	21.84	100.00	8.00	0.00
NDDN Centennial WY	98.45	65.52	22.06	99.00	7.00	0.00
NWS Denver CO (03017	83.55	55.22	25.62	100.00	6.00	0.00
NWS Denver CO (23062	16.16	52.90	22.19	100.00	9.00	0.00
NWS Grand Junction C	100.00	47.82	22.66	100.00	7.00	0.00
NWS Cheyenne WY (240	100.00	56.79	24.35	100.00	6.00	0.00
NWS Lander WY (24021	100.00	54.48	22.72	100.00	6.00	0.00
NWS Rock Springs (24	99.77	53.28	21.09	93.00	10.00	0.00
NWS Casper WY (24089	100.00	59.51	23.33	100.00	6.00	0.00
NWS Salt Lake City U	100.00	57.74	22.51	100.00	10.00	0.00
NWS Poccatello ID (2	100.00	60.37	22.61	100.00	10.00	0.00
MZVS Evanston WY (EV	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Hayden/Yampa Va	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Ogden/Hill AFB	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Jackson Hole WY	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Riverton WY (RI	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Rawlins WY (RWL	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Soda Springs ID	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Vernal UT (VELN	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Worland WY (WRL	0.00	-99.00	-99.00	-999.00	999.00	-9.00

Opaque Sky Cover (0-10)
site for Type= SKY

	Percent	Avg	Sig	Max	Min	%zero
Amoco	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Exxon	0.00	-99.00	-99.00	-999.00	999.00	-9.00
GenChem	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Naughton	0.00	-99.00	-99.00	-999.00	999.00	-9.00
OCI	0.00	-99.00	-99.00	-999.00	999.00	-9.00
TG Soda	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Anderson Ridge	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Burro Hill	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Camp Creek	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Cow Creek	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Elkhorn	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Getch Hollow	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Grace	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Grand Teton	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Pole Canyon	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Raspberry	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Riley Ridge	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Snider Basin	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Wind River	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Beaver Rim	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Bitter Creek	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Cont. Divide	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT First Divide	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Hiland	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Pathfinder Hi	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Zirkel Baggs	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Zirkel Craig Mtn.	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Zirkel Juniper Mtn.	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NDDN Pinedale WY	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NDDN Centennial WY	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NWS Denver CO (03017	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NWS Denver CO (23062	16.16	4.02	3.59	10.00	0.00	22.18
NWS Grand Junction C	100.00	3.69	3.78	10.00	0.00	34.91
NWS Cheyenne WY (240	83.30	4.93	3.90	10.00	0.00	20.97
NWS Lander WY (24021	100.00	4.18	3.78	10.00	0.00	25.51
NWS Rock Springs (24	100.00	4.29	3.88	10.00	0.00	28.39
NWS Casper WY (24089	100.00	4.43	3.84	10.00	0.00	23.11
NWS Salt Lake City U	100.00	4.44	3.95	10.00	0.00	27.92
NWS Poccatello ID (2	100.00	4.86	4.07	10.00	0.00	25.65
MZVS Evanston WY (EV	33.30	4.52	3.49	10.00	0.00	24.82
MZVS Hayden/Yampa Va	79.73	3.53	4.16	10.00	0.00	51.17
MZVS Ogden/Hill AFB	87.29	4.71	3.36	10.00	0.00	15.90
MZVS Jackson Hole WY	85.96	3.49	3.92	10.00	0.00	46.37
MZVS Riverton WY (RI	77.35	3.98	3.63	10.00	0.00	30.56
MZVS Rawlins WY (RWL	85.17	4.73	3.59	10.00	0.00	20.40
MZVS Soda Springs ID	59.29	5.35	3.90	10.00	0.00	20.06
MZVS Vernal UT (VELN	58.29	4.39	3.22	10.00	0.00	18.68
MZVS Worland WY (WRL	86.37	4.88	3.82	10.00	0.00	23.51

Ceiling Height (hundreds of feet)

site for Type=CEIL

	Percent	Avg	Sig	Max	Min	%zero
Amoco	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Exxon	0.00	-99.00	-99.00	-999.00	999.00	-9.00
GenChem	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Naughton	0.00	-99.00	-99.00	-999.00	999.00	-9.00
OCI	0.00	-99.00	-99.00	-999.00	999.00	-9.00
TG Soda	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Anderson Ridge	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Burro Hill	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Camp Creek	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Cow Creek	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Elkhorn	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Getch Hollow	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Grace	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Grand Teton	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Pole Canyon	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Raspberry	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Riley Ridge	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Snider Basin	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Wind River	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Beaver Rim	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Bitter Creek	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Cont. Divide	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT First Divide	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Hiland	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Pathfinder Hi	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Zirkel Baggs	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Zirkel Craig Mtn.	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Zirkel Juniper Mtn.	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NDDN Pinedale WY	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NDDN Centennial WY	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NWS Denver CO (03017	83.55	44.26	35.04	999.00	1.00	0.00
NWS Denver CO (23062	16.16	116.72	87.64	999.00	3.00	0.00
NWS Grand Junction C	100.00	112.09	65.84	999.00	1.00	0.00
NWS Cheyenne WY (240	100.00	94.39	86.03	999.00	0.00	0.11
NWS Lander WY (24021	100.00	104.43	90.10	999.00	1.00	0.00
NWS Rock Springs (24	100.00	87.79	68.20	999.00	0.00	0.10
NWS Casper WY (24089	100.00	91.79	78.17	999.00	1.00	0.00
NWS Salt Lake City U	100.00	106.32	63.33	999.00	2.00	0.00
NWS Poccatello ID (2	100.00	89.64	69.22	999.00	0.00	0.07
MZVS Evanston WY (EV	33.30	166.60	204.40	999.00	1.00	0.00
MZVS Hayden/Yampa Va	79.73	58.28	76.38	999.00	1.00	0.00
MZVS Ogden/Hill AFB	87.29	124.00	115.73	999.00	2.00	0.00
MZVS Jackson Hole WY	85.96	78.23	131.67	999.00	1.00	0.00
MZVS Riverton WY (RI	77.39	222.44	253.11	999.00	1.00	0.00
MZVS Rawlins WY (RWL	85.17	163.34	223.52	999.00	1.00	0.00
MZVS Soda Springs ID	59.29	196.93	252.25	999.00	8.00	0.00
MZVS Vernal UT (VELN	58.29	208.74	246.94	999.00	5.00	0.00
MZVS Worland WY (WRL	86.37	191.30	214.55	999.00	2.00	0.00

Precipitation Code (0 or 1)
site for Type=IPCD

	Percent	Avg	Sig	Max	Min	%zero
Amoco	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Exxon	0.00	-99.00	-99.00	-999.00	999.00	-9.00
GenChem	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Naughton	0.00	-99.00	-99.00	-999.00	999.00	-9.00
OCI	0.00	-99.00	-99.00	-999.00	999.00	-9.00
TG Soda	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Anderson Ridge	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Burro Hill	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Camp Creek	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Cow Creek	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Elkhorn	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Getch Hollow	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Grace	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Grand Teton	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Pole Canyon	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Raspberry	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Riley Ridge	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Snider Basin	0.00	-99.00	-99.00	-999.00	999.00	-9.00
RAWS Wind River	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Beaver Rim	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Bitter Creek	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Cont. Divide	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT First Divide	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Hiland	0.00	-99.00	-99.00	-999.00	999.00	-9.00
WYODOT Pathfinder Hi	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Zirkel Baggs	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Zirkel Craig Mtn.	0.00	-99.00	-99.00	-999.00	999.00	-9.00
Zirkel Juniper Mtn.	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NDDN Pinedale WY	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NDDN Centennial WY	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NWS Denver CO (03017	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NWS Denver CO (23062	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NWS Grand Junction C	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NWS Cheyenne WY (240	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NWS Lander WY (24021	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NWS Rock Springs (24	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NWS Casper WY (24089	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NWS Salt Lake City U	0.00	-99.00	-99.00	-999.00	999.00	-9.00
NWS Poccatello ID (2	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Evanston WY (EV	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Hayden/Yampa Va	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Ogden/Hill AFB	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Jackson Hole WY	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Riverton WY (RI	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Rawlins WY (RWL	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Soda Springs ID	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Vernal UT (VELN	0.00	-99.00	-99.00	-999.00	999.00	-9.00
MZVS Worland WY (WRL	0.00	-99.00	-99.00	-999.00	999.00	-9.00

Exhibit 2-1. CALMET input control file for a January CALMET simulation.

```
Pinedale, WY -TEST - 4km resolution -
1995 Met Data -
1 month run: Jan95
--------------- Run title (3 lines) ----------------------------------------

                    CALMET MODEL CONTROL FILE
                    -------------------------

--------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names


Subgroup (a)
------------
Default Name  Type           File Name
------------  ----           ---------
GEO.DAT       input    ! GEODAT=/disk13/Project/data/geo/geo.pinedale.4km.dat !
SURF.DAT      input    ! SRFDAT=/disk13/Project/calmet/inputs_jan/surf.950101_31
!
CLOUD.DAT     input    * CLDDAT=              *
PRECIP.DAT    input    ! PRCDAT=/disk13/Project/calmet/inputs_jan/precip.jan
!
MM4.DAT       input    ! MM4DAT=/disk13/Project/calmet/inputs_jan/mm4_9501.dat
!
WT.DAT        input    * WTDAT=               *

CALMET.LST    output   ! METLST=/disk13/Project/calmet/outputs/calmet.95jan.lst!
CALMET.DAT    output   ! METDAT=/disk13/Project/calmet/outputs/calmet.95jan.dat!
PACOUT.DAT    output   * PACDAT=              *

All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE

NUMBER OF UPPER AIR & OVERWATER STATIONS:

    Number of upper air stations (NUSTA)  No default     ! NUSTA =  0  !
    Number of overwater met stations
                                 (NOWSTA) No default     ! NOWSTA =  0  !

                        !END!
--------------------------------------------------------------------------------
Subgroup (b)
---------------------------------
Upper air files (one per station)
---------------------------------
Default Name  Type       File Name
------------  ----       ---------
--------------------------------------------------------------------------------
```

Exhibit 2-1. (Continued)

```
Subgroup (c)
----------------------------------------
Overwater station files (one per station)
----------------------------------------
Default Name  Type       File Name
------------  ----       ---------
--------------------------------------------------------------------------------
Subgroup (d)
----------------
Other file names
----------------

Default Name  Type       File Name
------------  ----       ---------
DIAG.DAT      input      * DIADAT=                    *
PROG.DAT      input      * PRGDAT=                    *

TEST.PRT      output     * TSTPRT=                    *
TEST.OUT      output     * TSTOUT=                    *
TEST.KIN      output     * TSTKIN=                    *
TEST.FRD      output     * TSTFRD=                    *
TEST.SLP      output     * TSTSLP=                    *

--------------------------------------------------------------------------------
NOTES: (1) File/path names can be up to 70 characters in length
       (2) Subgroups (a) and (d) must have ONE 'END' (surround by
           delimiters) at the end of the group
       (3) Subgroups (b) and (c) must have an 'END' (surround by
           delimiters) at the end of EACH LINE

                        !END!


--------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

     Starting date:   Year (IBYR) -- No default       ! IBYR=  95  !
                     Month (IBMO) -- No default       ! IBMO=   1  !
                       Day (IBDY) -- No default       ! IBDY=   1  !
                      Hour (IBHR) -- No default       ! IBHR=   0  !

     Base time zone         (IBTZ) -- No default       ! IBTZ=   7  !
        PST = 08, MST = 07
        CST = 06, EST = 05

     Length of run (hours) (IRLG) -- No default       ! IRLG=  744  !

     Run type              (IRTYPE) -- Default: 1      ! IRTYPE=  1  !

        0 = Computes wind fields only
```

Exhibit 2-1. (Continued)

```
            1 = Computes wind fields and micrometeorological variables
            (u*, w*, L, zi, etc.)
         (IRTYPE must be 1 to run CALPUFF or CALGRID)

      Compute special data fields required
      by CALGRID (i.e., 3-D fields of W wind
      components and temperature)
      in additional to regular              Default: T     ! LCALGRD = F !
      fields ? (LCALGRD)
      (LCALGRD must be T to run CALGRID)
      Flag to stop run after
      SETUP phase (ITEST)               Default: 2        ! ITEST=  2    !
      (Used to allow checking
      of the model inputs, files, etc.)
      ITEST = 1 - STOPS program after SETUP phase
      ITEST = 2 - Continues with execution of
                  COMPUTATIONAL phase after SETUP

!END!

--------------------------------------------------------------------------------

INPUT GROUP: 2 -- Grid control parameters
--------------

      HORIZONTAL GRID DEFINITION:

            No. X grid cells (NX)       No default      ! NX =   116  !
            No. Y grid cells (NY)       No default      ! NY =   100  !

      GRID SPACING (DGRIDKM)            No default      ! DGRIDKM = 4. !
                                        Units: km

      REFERENCE COORDINATES
      of SOUTHWEST corner of grid point (1,1)

         X coordinate (XORIGKM)         No default      ! XORIGKM = -335.0!
         Y coordinate (YORIGKM)         No default      ! YORIGKM = -258. !
                                        Units: km
         Latitude  (XLAT0)              No default      ! XLAT0 = 40.0749 !
         Longitude (XLON0)              No default      ! XLON0 = 112.611 !

      UTM ZONE (IUTMZN)                 Default: 0      ! IUTMZN =  12  !

      LAMBERT CONFORMAL PARAMETERS

      Rotate input winds from true north to
      map north using a Lambert conformal
      projection? (LLCONF)              Default: F      ! LLCONF = T !

      Latitude of 1st standard parallel   Default: 30.   ! XLAT1 = 30.000 !
      Latitude of 2nd standard parallel   Default: 60.   ! XLAT2 = 60.000 !
      (XLAT1 and XLAT2; + in NH, - in SH)
```

Exhibit 2-1. (Continued)

```
      Longitude (RLON0)                Default = 90.   ! RLON0 = 108.55 !
      (used only if LLCONF = T)
      (Positive = W. Hemisphere;
       Negative = E. Hemisphere)
      Origin Latitude (RLAT0)          Default = 40.   ! RLAT0 = 42.55 !
      (used only if IPROG > 2)
      (Positive = N. Hemisphere;
       Negative = S. Hemisphere)

   Vertical grid definition:

      No. of vertical layers (NZ)    No default      ! NZ =  9  !

      Cell face heights in arbitrary
      vertical grid (ZFACE(NZ+1))    No defaults
                                     Units: m
      ! ZFACE = 0.,20.,80.,160.,300.,600.,1000.,1500.,2200.,3000. !

!END!

------------------------------------------------------------------------------

INPUT GROUP: 3 -- Output Options
--------------


   DISK OUTPUT OPTION

      Save met. fields in an unformatted
      output file ?              (LSAVE)  Default: T      ! LSAVE = T !
      (F = Do not save, T = Save)

      Type of unformatted output file:
      (IFORMO)                            Default: 1     ! IFORMO =  1  !

           1 = CALPUFF/CALGRID type file (CALMET.DAT)
           2 = MESOPUFF-II type file     (PACOUT.DAT)


   LINE PRINTER OUTPUT OPTIONS:

      Print met. fields ?  (LPRINT)       Default: F      ! LPRINT = 0 !
      (F = Do not print, T = Print)
      (NOTE: parameters below control which
             met. variables are printed)

      Print interval
      (IPRINF) in hours                   Default: 1      ! IPRINF =  1  !
      (Meteorological fields are printed
       every  1  hours)
```

Exhibit 2-1. (Continued)

```
Specify which layers of U, V wind component
to print (IUVOUT(NZ)) -- NOTE: NZ values must be entered
(0=Do not print, 1=Print)
(used only if LPRINT=T)          Defaults: NZ*0
! IUVOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !
-----------------------


Specify which levels of the W wind component to print
(NOTE: W defined at TOP cell face --  9  values)
(IWOUT(NZ)) -- NOTE: NZ values must be entered
(0=Do not print, 1=Print)
(used only if LPRINT=T & LCALGRD=T)
-----------------------------------
                                     Defaults: NZ*0
 ! IWOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !


Specify which levels of the 3-D temperature field to print
(ITOUT(NZ)) -- NOTE: NZ values must be entered
(0=Do not print, 1=Print)
(used only if LPRINT=T & LCALGRD=T)
-----------------------------------
                                     Defaults: NZ*0
 ! ITOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !

Specify which meteorological fields
to print
(used only if LPRINT=T)              Defaults: 0 (all variables)
-----------------------


  Variable            Print ?
                   (0 = do not print,
                    1 = print)
  --------         ------------------

!  STABILITY  =          0           ! - PGT stability class
!  USTAR      =          0           ! - Friction velocity
!  MONIN      =          0           ! - Monin-Obukhov length
!  MIXHT      =          0           ! - Mixing height
!  WSTAR      =          0           ! - Convective velocity scale
!  PRECIP     =          0           ! - Precipitation rate
!  SENSHEAT   =          0           ! - Sensible heat flux
!  CONVZI     =          0           ! - Convective mixing ht.


Testing and debug print options for micrometeorological module

   Print input meteorological data and
   internal variables (LDB)          Default: F       ! LDB = F !
   (F = Do not print, T = print)
   (NOTE: this option produces large amounts of output)
```

Exhibit 2-1. (Continued)

```
   First time step for which debug data
   are printed (NN1)                Default: 1       ! NN1 =  1  !

   Last time step for which debug data
   are printed (NN2)                Default: 1       ! NN2 =  24  !


 Testing and debug print options for wind field module
 (all of the following print options control output to
  wind field module's output files: TEST.PRT, TEST.OUT,
  TEST.KIN, TEST.FRD, and TEST.SLP)

   Control variable for writing the test/debug
   wind fields to disk files (IOUTD)
   (0=Do not write, 1=write)        Default: 0       ! IOUTD =  0  !

   Number of levels, starting at the surface,
   to print (NZPRN2)                Default: 1       ! NZPRN2 =  0  !

   Print the INTERPOLATED wind components ?
   (IPR0) (0=no, 1=yes)             Default: 0       !  IPR0 =  0  !

   Print the TERRAIN ADJUSTED surface wind
   components ?
   (IPR1) (0=no, 1=yes)             Default: 0       !  IPR1 =  0  !

   Print the SMOOTHED wind components and
   the INITIAL DIVERGENCE fields ?
   (IPR2) (0=no, 1=yes)             Default: 0       !  IPR2 =  0  !

   Print the FINAL wind speed and direction
   fields ?
   (IPR3) (0=no, 1=yes)             Default: 0       !  IPR3 =  0  !

   Print the FINAL DIVERGENCE fields ?
   (IPR4) (0=no, 1=yes)             Default: 0       !  IPR4 =  0  !

   Print the winds after KINEMATIC effects
   are added ?
   (IPR5) (0=no, 1=yes)             Default: 0       !  IPR5 =  0  !

   Print the winds after the FROUDE NUMBER
   adjustment is made ?
   (IPR6) (0=no, 1=yes)             Default: 0       !  IPR6 =  0  !

   Print the winds after SLOPE FLOWS
   are added ?
   (IPR7) (0=no, 1=yes)             Default: 0       !  IPR7 =  0  !
```

Exhibit 2-1. (Continued)

```
         Print the FINAL wind field components ?
         (IPR8) (0=no, 1=yes)              Default: 0       !  IPR8 =  0  !

!END!

----------------------------------------------------------------------------

INPUT GROUP: 4 -- Meteorological data options
--------------


    NUMBER OF SURFACE & PRECIP. METEOROLOGICAL STATIONS

       Number of surface stations    (NSSTA)  No default     ! NSSTA =  48  !
       Number of precipitation stations
                                     (NPSTA)  No default     ! NPSTA =  46  !

    CLOUD DATA OPTIONS
       Griddid cloud fields:
                                   (ICLOUD)  Default: 0      ! ICLOUD =  0  !
       ICLOUD = 0 - Gridded clouds not used
       ICLOUD = 1 - Gridded CLOUD.DAT generated as OUTPUT
       ICLOUD = 2 - Gridded CLOUD.DAT read as INPUT

    FILE FORMATS

       Surface meteorological data file format
                                   (IFORMS)  Default: 2      ! IFORMS =  2  !
       (1 = unformatted (e.g., SMERGE output))
       (2 = formatted   (free-formatted user input))

       Precipitation data file format
                                   (IFORMP)  Default: 2      ! IFORMP =  2  !
       (1 = unformatted (e.g., PMERGE output))
       (2 = formatted   (free-formatted user input))

       Cloud data file format
                                   (IFORMC)  Default: 2      ! IFORMC =  1  !
       (1 = unformatted - CALMET unformatted output)
       (2 = formatted   - free-formatted CALMET output or user input)

!END!

----------------------------------------------------------------------------
```

Exhibit 2-1. (Continued)

```
INPUT GROUP: 5 -- Wind Field Options and Parameters
--------------


    WIND FIELD MODEL OPTIONS
       Model selection variable (IWFCOD)     Default: 1      ! IWFCOD =  1  !
          0 = Objective analysis only
          1 = Diagnostic wind module

       Compute Froude number adjustment
       effects ? (IFRADJ)                    Default: 1      ! IFRADJ =  1  !
       (0 = NO, 1 = YES)

       Compute kinematic effects ? (IKINE)   Default: 0      ! IKINE  =  1  !
       (0 = NO, 1 = YES)

       Use O'Brien procedure for adjustment
       of the vertical velocity ? (IOBR)     Default: 0      ! IOBR =  0  !
       (0 = NO, 1 = YES)

       Compute slope flows? (ISLOPE)         Default : 1      ! ISLOPE=1!

       Extrapolate surface wind observations
       to upper layers ? (IEXTRP)            Default: -4     ! IEXTRP = 1  !
       (1 = no extrapolation is done,
        2 = power law extrapolation used,
        3 = user input multiplicative factors
            for layers 2 - NZ used (see FEXTRP array)
        4 = similarity theory used
        -1, -2, -3, -4 = same as above except layer 1 data
            at upper air stations are ignored

       Extrapolate calm winds aloft? (ICALM)  Default : 0    ! ICALM = 0!

       Layer-dependent biases modifying the weights of
       surface and upper air stations (BIAS(NZ))
         -1<=BIAS<=1
       Negative BIAS reduces the weight of upper air stations
         (e.g. BIAS=-0.1 reduces the weight of upper air stations
       by 10%; BIAS= -1, reduces their weight by 100 %)
       Positive BIAS reduces the weight of surface stations
         (e.g. BIAS= 0.2 reduces the weight of surface stations
       by 20%; BIAS=1 reduces their weight by 100%)
       Zero BIAS leaves weights unchanged (1/R**2 interpolation)
       Default: NZ*0
                              ! BIAS = 0., 0, 0, 0, 0, 0, 0, 0,0  !

       Minimum distance from nearest upper air station
       to surface station for which extrapolation
       of surface winds at surface station will be allowed
       (RMIN2: Set to -1 for IEXTRP = 4 or other situations
        where all surface stations should be extrapolated)
                                              Default: 4.     ! RMIN2 = -1.0 !
```

Exhibit 2-1. (Continued)

```
   Use gridded prognostic wind field model
   output fields as input to the diagnostic
   wind field model (IPROG)              Default: 0      ! IPROG =  4  !
   (0 = No, [IWFCOD = 0 or 1]
    1 = Yes, use CSUMM prog. winds as Step 1 field, [IWFCOD = 0]
    2 = Yes, use CSUMM prog. winds as initial guess field [IWFCOD = 1]
    3 = Yes, usr MM4 prog. winds as Step 1 field [IWFCOD = 0]
    4 = Yes, use MM4 prog. winds as initial guess field [IWFCOD = 1]
    5 = Yes, use MM4 prog. winds as observations [IWFCOD = 1]

RADIUS OF INFLUENCE PARAMETERS

   Use varying radius of influence       Default: F      ! LVARY =  F!
   (if no stations are found within RMAX1,RMAX2,
    or RMAX3, then the closest station will be used)

   Maximum radius of influence over land
   in the surface layer (RMAX1)          No default      ! RMAX1 = 20. !
                                         Units: km
   Maximum radius of influence over land
   aloft (RMAX2)                         No default      ! RMAX2 = 40. !
                                         Units: km
   Maximum radius of influence over water
   (RMAX3)                               No default      ! RMAX3 = 0. !
                                         Units: km

OTHER WIND FIELD INPUT PARAMETERS

   Minimum radius of influence used in
   the wind field interpolation (RMIN)   Default: 0.1    ! RMIN = 0.1 !
                                         Units: km
   Radius of influence of terrain
   features (TERRAD)                     No default      ! TERRAD = 20. !

                                         Units: km
   Relative weighting of the first
   guess field and observations in the
   SURFACE layer (R1)                    No default      ! R1 = 10. !
   (R1 is the distance from an           Units: km
   observational station at which the
   observation and first guess field are
   equally weighted)

   Relative weighting of the first
   guess field and observations in the
   layers ALOFT (R2)                     No default      ! R2 = 15. !
   (R2 is applied in the upper layers    Units: km
   in the same manner as R1 is used in
   the surface layer).

   Relative weighting parameter of the
   prognostic wind field data (RPROG)    No default      ! RPROG = 0. !
   (Used only if IPROG = 1)              Units: km
   ----------------------
```

Exhibit 2-1. (Continued)

```
      Maximum acceptable divergence in the
      divergence minimization procedure
      (DIVLIM)                              Default: 5.E-6  ! DIVLIM= 5.0E-06 !

      Maximum number of iterations in the
      divergence min. procedure (NITER)     Default: 50     ! NITER =  1  !

      Number of passes in the smoothing
      procedure (NSMTH(NZ))
      NOTE: NZ values must be entered
           Default: 2,(mxnz-1)*4 ! NSMTH =
2 ,  2 , 2 ,  2,  2 ,  2 ,  2 ,  2 ,  2  !

      Maximum number of stations used in
      each layer for the interpolation of
      data to a grid point (NINTR2(NZ))
      NOTE: NZ values must be entered       Default: 99.    ! NINTR2 =
99,99,99,99,99,99,99,99,99  !

      Critical Froude number (CRITFN)       Default: 1.0    ! CRITFN = 1. !

      Empirical factor controlling the
      influence of kinematic effects
      (ALPHA)                               Default: 0.1    ! ALPHA = 0.1 !

      Multiplicative scaling factor for
      extrapolation of surface observations
      to upper layers (FEXTR2(NZ))          Default: NZ*0.0
      ! FEXTR2 = 0., 0., 0., 0., 0., 0., 0., 0., 0. !
      (Used only if IEXTRP = 3 or -3)


   BARRIER INFORMATION

      Number of barriers to interpolation
      of the wind fields (NBAR)             Default: 0      ! NBAR =  0  !

      THE FOLLOWING 4 VARIABLES ARE INCLUDED
      ONLY IF NBAR > 0
      NOTE: NBAR values must be entered     No defaults
            for each variable               Units: km

         X coordinate of BEGINNING
         of each barrier (XBBAR(NBAR))      ! XBBAR = 0. !
         Y coordinate of BEGINNING
         of each barrier (YBBAR(NBAR))      ! YBBAR = 0. !

         X coordinate of ENDING
         of each barrier (XEBAR(NBAR))      ! XEBAR = 0. !
         Y coordinate of ENDING
         of each barrier (YEBAR(NBAR))      ! YEBAR = 0. !
```

Exhibit 2-1. (Continued)

```
DIAGNOSTIC MODULE DATA INPUT OPTIONS

   Surface temperature (IDIOPT1)          Default: 0      ! IDIOPT1 =  0  !
      0 = Compute internally from
          hourly surface observations
      1 = Read preprocessed values from
          a data file (DIAG.DAT)

      Surface met. station to use for
      the surface temperature (ISURFT)    No default     ! ISURFT =  36  !
      (Must be a value from 1 to NSSTA)
      (Used only if IDIOPT1 = 0)
      -------------------------

   Domain-averaged temperature lapse
   rate (IDIOPT2)                         Default: 0     ! IDIOPT2 =  0  !
      0 = Compute internally from
          twice-daily upper air observations
      1 = Read hourly preprocessed values
          from a data file (DIAG.DAT)

      Upper air station to use for
      the domain-scale lapse rate (IUPT) No default     ! IUPT   =  0  !
      (Must be a value from 1 to NUSTA)
      (Used only if IDIOPT2 = 0)
      -------------------------
      Depth through which the domain-scale
      lapse rate is computed (ZUPT)       Default: 200.  ! ZUPT = 200. !
      (Used only if IDIOPT2 = 0)          Units: meters
      -------------------------

   Domain-averaged wind components
   (IDIOPT3)                              Default: 0     ! IDIOPT3 =  0  !
      0 = Compute internally from
          twice-daily upper air observations
      1 = Read hourly preprocessed values
          a data file (DIAG.DAT)

      Upper air station to use for
      the domain-scale winds (IUPWND)     Default: -1    ! IUPWND = -1  !
      (Must be a value from -1 to NUSTA)
      (Used only if IDIOPT3 = 0)
      -------------------------

      Bottom and top of layer through
      which the domain-scale winds
      are computed
     (ZUPWND(1), ZUPWND(2))          Defaults: 1., 1000. ! ZUPWND= 1., 1000. !
      (Used only if IDIOPT3 = 0)      Units: meters
      -------------------------

   Observed surface wind components
   for wind field module (IDIOPT4)  Default: 0      ! IDIOPT4 =  0  !
```

Exhibit 2-1. (Continued)

```
          0 = Read WS, WD from a surface
              data file (SURF.DAT)
          1 = Read hourly preprocessed U, V from
              a data file (DIAG.DAT)

       Observed upper air wind components
       for wind field module (IDIOPT5)  Default: 0      ! IDIOPT5 =  0  !
          0 = Read WS, WD from an upper
              air data file (UP1.DAT, UP2.DAT, etc.)
          1 = Read hourly preprocessed U, V from
              a data file (DIAG.DAT)

       LAKE BREEZE INFORMATION

          Use Lake Breeze Module  (LLBREZE)
                                          Default: F       ! LLBREZE = F !

           Number of lake breeze regions (NBOX)            ! NBOX =  0  !

        X Grid line 1 defining the region of interest
                                                          ! XG1 = 0. !
        X Grid line 2 defining the region of interest
                                                          ! XG2 = 0. !
        Y Grid line 1 defining the region of interest
                                                          ! YG1 = 0. !
        Y Grid line 2 defining the region of interest
                                                          ! YG2 = 0. !

         X Point defining the coastline (Straight line)
                   (XBCST)  (KM)   Default: none    ! XBCST = 0. !

         Y Point defining the coastline (Straight line)
                   (YBCST)  (KM)   Default: none    ! YBCST = 0. !

         X Point defining the coastline (Straight line)
                   (XECST)  (KM)   Default: none    ! XECST = 0. !

         Y Point defining the coastline (Straight line)
                   (YECST)  (KM)   Default: none    ! YECST = 0. !


       Number of stations in the region     Default: none ! NLB = 1 !
       (Surface stations + upper air stations)

       Station ID's  in the region   (METBXID(NLB))
       (Surface stations first, then upper air stations)
         ! METBXID = 0 !

!END!
```

Exhibit 2-1. (Continued)

```
INPUT GROUP: 6 -- Mixing Height, Temperature and Precipitation Parameters
--------------

    EMPIRICAL MIXING HEIGHT CONSTANTS

       Neutral, mechanical equation
       (CONSTB)                          Default: 1.41    ! CONSTB = 1.41!
       Convective mixing ht. equation
       (CONSTE)                          Default: 0.15    ! CONSTE = 0.15 !
       Stable mixing ht. equation
       (CONSTN)                          Default: 2400.   ! CONSTN = 2400.!
       Overwater mixing ht. equation
       (CONSTW)                          Default: 0.16    ! CONSTW = 0.16 !
       Absolute value of Coriolis
       parameter (FCORIOL)               Default: 1.E-4   ! FCORIOL = 1.0E-04!
                                         Units: (1/s)

    SPATIAL AVERAGING OF MIXING HEIGHTS

       Conduct spatial averaging
       (IAVEZI)  (0=no, 1=yes)           Default: 1       ! IAVEZI =  1  !

       Max. search radius in averaging
       process (MNMDAV)                  Default: 1       ! MNMDAV =  1  !
                                         Units: Grid
                                                cells

       Half-angle of upwind looking cone
       for averaging (HAFANG)            Default: 30.     ! HAFANG = 30. !
                                         Units: deg.

       Layer of winds used in upwind
       averaging (ILEVZI)                Default: 1       ! ILEVZI =  5  !
       (must be between 1 and NZ)

    OTHER MIXING HEIGHT VARIABLES

       Minimum potential temperature lapse
       rate in the stable layer above the
       current convective mixing ht.     Default: 0.001   ! DPTMIN = 0.001 !
       (DPTMIN)                          Units: deg. K/m
       Depth of layer above current conv.
       mixing height through which lapse Default: 200.    ! DZZI = 200. !
       rate is computed (DZZI)           Units: meters

       Minimum overland mixing height    Default:  50.    ! ZIMIN = 20. !
       (ZIMIN)                           Units: meters
       Maximum overland mixing height    Default: 3000.   ! ZIMAX = 2500. !
       (ZIMAX)                           Units: meters
```

Exhibit 2-1. (Continued)

```
   Minimum overwater mixing height        Default:   50.  ! ZIMINW = 50. !
   (ZIMINW) -- (Not used if observed      Units: meters
   overwater mixing hts. are used)
   Maximum overwater mixing height        Default: 3000.  ! ZIMAXW = 2500. !
   (ZIMAXW) -- (Not used if observed      Units: meters
   overwater mixing hts. are used)


TEMPERATURE PARAMETERS

   Interpolation type
   (1 = 1/R ; 2 = 1/R**2)                 Default:1         ! IRAD =  1  !

   Radius of influence for temperature
   interpolation (TRADKM)                 Default: 500.     ! TRADKM =  100. !
                                          Units: km

   Maximum Number of stations to include
   in temperature interpolation (NUMTS)   Default: 5        ! NUMTS = 5  !

   Conduct spatial averaging of temp-
   eratures (IAVET)  (0=no, 1=yes)          Default: 1     ! IAVET =  1  !
   (will use mixing ht MNMDAV,HAFANG
    so make sure they are correct)

   Default temperature gradient         Default: -.0098 ! TGDEFB = -0.0098 !
   below the mixing height over
   water (K/m) (TGDEFB)

   Default temperature gradient         Default: -.0045 ! TGDEFA = -0.0045 !
   above the mixing height over
   water (K/m) (TGDEFA)

   Beginning (JWAT1) and ending (JWAT2)
   land use categories for temperature                  ! JWAT1 =  999  !
   interpolation over water -- Make                     ! JWAT2 =  999  !
   bigger than largest land use to disable

PRECIP INTERPOLATION PARAMETERS

   Method of interpolation (NFLAGP)       Default = 2    ! NFLAGP =  2  !
    (1=1/R,2=1/R**2,3=EXP/R**2)
```

Exhibit 2-1. (Continued)

```
      Radius of Influence (km) (SIGMAP)      Default = 100.0  ! SIGMAP = 100. !
        (0.0 => use half dist. btwn
         nearest stns w & w/out
         precip when NFLAGP = 3)
       Minimum Precip. Rate Cutoff (mm/hr)    Default = 0.01  ! CUTP = 0.01 !
        (values < CUTP = 0.0 mm/hr)

!END!

-------------------------------------------------------------------------------

INPUT GROUP: 7 -- Surface meteorological station parameters
--------------

     SURFACE STATION VARIABLES
     (One record per station -- 48  records in all)

                1     2
          Name   ID            X coord.    Y coord.    Time    Anem.
                                 (km)        (km)       zone   Ht.(m)
        ------------------------------------------------------------
! SS1  ='Amoc' 01001       -188.837     -117.73     7.     10. !
! SS2  ='Exxo' 01002       -128.247      -75.08     7.     10. !
! SS3  ='GenC' 01003        -97.396     -102.53     7.     10. !
! SS4  ='Naug' 01004       -163.727      -82.89     7.     10. !
! SS5  ='OCI ' 01005        -89.941      -87.57     7.     10. !
! SS6  ='TG S' 01006       -107.679      -91.60     7.     10. !
! SS7  ='Ande' 02001        -31.013      -12.05     7.     10. !
! SS8  ='Burr' 02002       -141.055      140.20     7.     10. !
! SS9  ='Camp' 02003         79.256      -21.46     7.     10. !
! SS10 ='Cow ' 02004         78.342     -137.15     7.     10. !
! SS11 ='Elkh' 02005        -82.435      121.92     7.     10. !
! SS12 ='Getc' 02006       -213.753      -23.29     7.     10. !
! SS13 ='Grac' 02007       -261.735        4.03     7.     10. !
! SS14 ='Gran' 02008       -167.686      128.38     7.     10. !
! SS15 ='Pole' 02009       -259.041       42.35     7.     10. !
! SS16 ='Rasp' 02010       -114.350      100.16     7.     10. !
! SS17 ='Rile' 02011       -152.455       -5.34     7.     10. !
! SS18 ='Snid' 02012       -156.708       -4.43     7.     10. !
! SS19 ='Wind' 02013        -44.560       46.20     7.     10. !
! SS20 ='Bea ' 03001         20.818        4.01     7.     10. !
! SS21 ='Bit ' 03002         -2.654      -97.24     7.     10. !
! SS22 ='Con ' 03003         68.278      -89.45     7.     10. !
! SS23 ='Fir ' 03004       -179.798      -132.42     7.     10. !
! SS24 ='Hil ' 03005         96.447       59.00     7.     10. !
! SS25 ='Pat ' 03006        134.381        2.50     7.     10. !
! SS26 ='Bag ' 04001         74.785      -166.36     7.     10. !
! SS27 ='Cra ' 04002         78.747      -225.58     7.     10. !
! SS28 ='Jun ' 04003         42.655      -225.92     7.     10. !
! SS29 ='Pine' 05001        -97.579       41.61     7.     10. !
! SS30 ='Cent' 05002        194.065      -130.50     7.     10. !
! SS31 ='Denv' 06001        335.813      -324.41     7.     10. !
! SS32 ='Denv' 06002        335.813      -324.41     7.     10. !
```

```
! SS33 ='Gran' 06003        18.459     -376.04     7.     10. !
! SS34 ='Chey' 06004       329.457     -149.82     7.     10. !
! SS35 ='Land' 06005         8.722       -6.44     7.     10. !
! SS36 ='Rock' 06006       -39.594     -127.90     7.     10. !
! SS37 ='Casp' 06007       179.774        2.55     7.     10. !
! SS38 ='Salt' 06008      -247.589     -219.23     7.     10. !
! SS39 ='Pocc' 06009      -293.899        3.58     7.     10. !
! SS40 ='Evan' 07001      -198.469     -142.21     7.     10. !
! SS41 ='Hayd' 07002       115.118     -241.22     7.     10. !
! SS42 ='Ogde' 07003      -245.962     -154.60     7.     10. !
! SS43 ='Jack' 07004      -147.631       88.80     7.     10. !
! SS44 ='Rive' 07005        21.998       51.64     7.     10. !
! SS45 ='Rawl' 07006       115.315     -114.08     7.     10. !
! SS46 ='Soda' 07007      -222.333      -13.32     7.     10. !
! SS47 ='Vern' 07008       -62.525     -245.16     7.     10. !
! SS48 ='Worl' 07009        75.487      111.15     7.     10. !
--------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Five digit integer for station ID

!END!
```

```
INPUT GROUP: 8 -- Upper air meteorological station parameters
--------------

     UPPER AIR STATION VARIABLES
     (One record per station --  0  records in all)

            1     2
         Name    ID      X coord.    Y coord.  Time zone
                            (km)        (km)
        ------------------------------------------------
--------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Five digit integer for station ID

!END!
```

Exhibit 2-1. (Continued)

```
INPUT GROUP: 9 -- Precipitation station parameters
--------------

     PRECIPITATION STATION VARIABLES
     (One record per station --  46  records in all)
     (NOT INCLUDED IF NPSTA = 0)

           1          2
         Name    Station    X coord.  Y coord.
                   Code       (km)      (km)
         ------------------------------------

! PS1  ='AFTO'   0027      -188.157       22.51  !
! PS2  ='ALTA'   0140      -192.552      135.52  !
! PS3  ='BAGG'   0484        73.119     -162.79  !
! PS4  ='BEDF'   0603      -186.424       36.80  !
! PS5  ='BIG '   0695      -124.084        1.21  !
! PS6  ='BIG '   0696      -109.529        2.74  !
! PS7  ='BITT'   0761         2.681     -103.99  !
! PS8  ='BLAC'   0778        63.481      118.54  !
! PS9  ='BOND'   0865      -144.904       71.54  !
! PS10 ='BOUL'   0951       -89.507       18.55  !
! PS11 ='BOYS'   1000        28.619       93.22  !
! PS12 ='BURR'   1284       -57.277       88.04  !
! PS13 ='CHUR'   1736      -123.808     -122.53  !
! PS14 ='CORA'   2054      -114.096       42.24  !
! PS15 ='DANI'   2242      -124.619       40.65  !
! PS16 ='DARW'   2375      -126.163       94.42  !
! PS17 ='DIVE'   2595       -30.008       73.52  !
! PS18 ='EVAN'   3100      -194.204     -135.16  !
! PS19 ='FARS'   3170       -71.727      -39.03  !
! PS20 ='FONT'   3396      -121.279      -59.80  !
! PS21 ='GAS '   3801        84.081       31.02  !
! PS22 ='GREE'   4065       -72.533     -110.75  !
! PS23 ='JACK'   4910      -172.777      102.70  !
! PS24 ='JEFF'   4925        56.815       -5.12  !
! PS25 ='KEMM'   5105      -159.027      -76.90  !
! PS26 ='LA B'   5252      -131.308      -29.11  !
! PS27 ='LAND'   5390       -14.453       28.69  !
! PS28 ='LONE'   5703      -129.911     -158.31  !
! PS29 ='MOOS'   6428      -168.396      120.49  !
! PS30 ='MORA'   6440      -157.485      141.70  !
! PS31 ='MOUN'   6555      -144.311     -136.46  !
! PS32 ='MUDD'   6595        87.395      -19.11  !
! PS33 ='PAVI'   7115       -10.432       75.25  !
! PS34 ='PINE'   7260      -103.726       34.90  !
! PS35 ='RAWL'   7533       108.284      -79.76  !
! PS36 ='RIVE'   7760        13.096       51.97  !
! PS37 ='ROCK'   7845       -41.585     -102.06  !
! PS38 ='SAGE'   7955      -196.273      -70.49  !
! PS39 ='SHOS'   8209        22.205       66.33  !
! PS40 ='SOUT'   8385       -19.829       -8.92  !
! PS41 ='TEN '   8858        91.710      136.80  !
! PS42 ='THER'   8875        27.206      118.27  !
! PS43 ='THER'   8884        27.206      118.27  !
```

Exhibit 2-1. (Concluded)

```
! PS44 ='THER'   8888        -11.646       125.39  !
! PS45 ='WAMS'   9459         46.893       -94.84  !
! PS46 ='WORL'   9785         45.092       152.40  !
--------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Six digit station code composed of state
        code (first 2 digits) and station ID (last
        4 digits)

!END!
```